

REMARKS

Reconsideration of this application as amended is respectfully requested.

Claims 1-25 are pending. Claims 1-3 and 5-25 stand rejected. Claim 4 has been withdrawn from consideration.

Claims 1, 3, 5-17, and 19-22 have been amended. Claims 2, 4, 18, and 23-25 have been cancelled. New claims 26-29 have been added. Support for the amendments is found in the specification, the drawings, and in the claims as originally filed. Applicants submit that the amendments do not add new matter.

Restriction Requirements

The Office Action has required restriction to one of the inventions in this application under 35 USC §121. The Applicants affirm election to prosecute claims 1-3 and 5-25 without traverse.

Rejections Under 35 U.S.C. § 112

The Examiner has rejected claims 5, 8, 10, 12-13, and 17-23 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. The Examiner has stated that

Regarding claims 13 and 14, the claimed subject matter of “in a range of approximately 5-100 volume% fusible” renders the scope of the claim indefinite since, this range 5-100 volume % is not supported in the disclosure. As regard claim 19, it is not clear if whether applicant claims “a non-fusible particle” is part of the thermal interface material or not.

Claim 5 recites the limitation “the thermal conductivity of the non-fusible particle filler” in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 8 recites the limitation “the non-fusible particle” in line 1; and “the group” in line 2. There are insufficient antecedent bases for these limitations in the claim.

Claim 10 recites the limitation “the total filler” in line 1, and “the range” in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 12 recites the limitation “the non-fusible particle filler” in line 1 and “the range” in line 1. There are insufficient antecedent bases for these limitations in the claim.

Claims 13 and 14 recite the limitation “the volume percent of fusible filler to non-fusible particle filler” in line 1. There is insufficient antecedent basis for this limitation in the claims.

Claim 17 recites the limitation “the group” in line 1. There is insufficient antecedent basis for this limitation in the claim.

Claim 18 recites the limitation “the solder” in line 1, and “the group” in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 20 recites the limitation “the particle filler” in line 4. There is insufficient antecedent basis for this limitation in the claim.

Claim 21 recites the limitation “the group” in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 23 recites the limitation “the group” in line 2. There is insufficient antecedent basis for this limitation in the claim.

(Office Action mailed February 6, 2003, page 3, paragraph 4-page 4, paragraph 10)

In response, applicants have amended the claims to more distinctly claim the subject matter, which applicants regard as their invention. Antecedent basis has been provided for claim limitations where lacking. In regard to claims 8, 17, and 21, which contain the limitation “the group,” each appears to be valid Markush claim expression.

Rejections Under 35 U.S.C. 102(b)

Claims 1-3 and 6-8 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S.

Patent No. 4,606,962 of Reylek et al. (“Reylek”). The Examiner stated that

Reylek discloses (figure 3 and column 4, lines 38-45) that a thermal interface material comprising a polymer material, which acts as an adhesive (34); a silver or copper particle filler are coated with a solder material.

(Office Action mailed February 6, 2003, page 5, paragraph 2)

Reylek discloses that

A preferred range of thicknesses for the adhesive between particles is from 0.01 to 0.05 mm, and the average particle thickness is preferably between 20 and 80% greater than the adhesive thickness between particles. When the particles have highly uniform thicknesses, excellent results are attained at an average particle diameter only 5% greater than the adhesive thickness between particles.

(Reylek col. 4, lines 38-45)

Claim 1, as amended, includes the following limitations:

A thermal interface material, comprising:

a binder material;

a fusible filler randomly positioned within the binder material; and

a plurality of non-fusible particles randomly positioned within the binder material.

(Amended claim 1) (Emphasis added)

Applicants respectfully submit that claim 1, as amended, is not anticipated by Reylek. Amended claim 1 includes the limitation of “randomly positioned” fusible filler and non-fusible particles. The particles of Reylek are not randomly positioned, but must be deliberately positioned such that electrical contact is made between the two surfaces that are interfaced (e.g., the two substrates of Reylek). This is because Reylek describes an “electrical” (as well as thermal) adhesive. This means that the positioning of the particles (and the size of the particles as well) must be such that when the two substrates meet, the part of the adhesive which covered the particles is “forced out” and provides an electrically conductive area at each surface of the layer of adhesive. In contrast, the claimed present invention, for example as claimed in amended claim 1, includes randomly positioned fusible filler and non-fusible particles, which allows for variable sized particles and reduced manufacturing concerns and costs.

Therefore applicants respectfully submit that amended claim 1 is not anticipated by Reylek. Given that claims 3, and 6-8 contain the limitation of randomly positioned fusible filler

and non-fusible particles, applicants respectfully submit that claims 3, and 6-8 are likewise not anticipated by Reylek. Moreover, given that new claims 26-29 contain the limitation of randomly positioned fusible filler and non-fusible particles, applicants respectfully submit that new claims 26-29 are likewise not anticipated by Reylek.

Claims 1-3, 5-10, 15-18, and 20-23 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Japanese Patent No. JP 07179832A, of Toyota Jidosha ("Toyota"). The Examiner stated that

Toyota discloses (figures 1-3, and table 4) that a thermal interface material that has a conductive filler (2) embedded within an adhesive material (1) wherein the conductive filler comprises of a non-fusible particle of silver (20) and a solder alloy (21) coated on the particle (20). The solder alloy is selected to be a combination of Bi (57%) and Sn (43%) in order to obtain a melting temperature of 139 degrees (C). It is well known in the art that the thermal conductivity of silver is greater than the solder alloy of Bi and Sn. Toyota further discloses (paragraph 13) that the total filler (2) is in a range of approximately 70-90% weight of the thermal interface material.

(Office Action mailed February 6, 2003, page 5, paragraph 3)

Applicants respectfully submit that amended claim 1 is not anticipated by Toyota for the reasons discussed above in reference to Reylek. Toyota also is an electrically conductive adhesive. Toyota appears to be less concerned with specific shape and deformation of the particles than Reylek. Toyota nevertheless makes clear that the particles must be positioned so as to form an electrically conductive path from one surface to the other.

Therefore applicants respectfully submit that amended claim 1 is not anticipated by Toyota. Given that claims 3, 5-10, 15-17 and 20-22 contain the limitation of randomly positioned fusible filler and non-fusible particles, applicants respectfully submit that claims 3, 5-10, 15-17 and 20-22 are likewise not anticipated by Toyota. Moreover, given that new claims 26-29 contain the limitation of randomly positioned fusible filler and non-fusible particles, applicants respectfully submit that new claims 26-29 are likewise not anticipated by Toyota.

Additionally, new claim 28 includes the limitation of the binder being non-adhesive, neither Reylek, nor Toyota includes such a limitation as both are addressing adhesives.

Rejections Under 35 U.S.C. § 103(a)

Claims 11-14 stand rejected under 35 U.S.C. § 103(a) as being obvious over Toyota. The Examiner has stated that

Toyota substantially discloses all of applicant's claimed invention as discussed above except for the limitation regarding the physical composition of the thermal interface material. It would have been obvious to one having ordinary skill in the art at the time the invention was made to select the claimed range of physically composition between the fusible and the non-fusible particle in view of Toyota's physical composition of the fusible and non-fusible particle, since it has been held that where the general condition of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

(Office Action mailed February 6, 2003, page 6, paragraph 2)

Applicants respectfully submit that amended claim 1 is not obvious under 35 U.S.C. § 103(a) in view of Toyota for the reasons discussed above. Given that claims 11-14 depend, directly or indirectly, from claim 1, applicants submit that claims 11-14 are not obvious under 35 U.S.C. § 103(a) in view of Toyota.

Claim 19 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Reylek in view of U.S. Patent No. 4,869,954 of Squitieri ("Squitieri").

In rejecting claim 19 under 35 U.S.C. § 103(a) as being unpatentable over Reylek in view of Squitieri, the Examiner has stated that

Reylek discloses substantially all of applicant's claimed invention as discussed above except for the limitation that a diameter for a conductive filler can be approximately 25 microns. Squitieri discloses (column 4, lines 11-15) that a thermal interface material (10) having conductive fillers embedded within a binder, wherein the conductive fillers has a particle size from 1 micron to about 50 microns so as not to distort the surface of the thermally conductive material. It would have been obvious to one having ordinary skill in the art at the time the

invention was made select the conductive filler's size from 1 micron to about 50 microns so as not to distort the surface of the thermally conductive material.

(Office Action mailed February 6, 2003, page 6, paragraph 3)

Squitieri discloses that

The particles should be of a sufficiently small size so as to not distort the surface of the thermally conductive material. Preferably the filler will be of a size from about 1 micron to about 50 microns, more preferably in a range of from about 5 microns to about 25 microns, most preferably about 10 microns.

(Squitieri col. 4, lines 11-16)

Applicants respectfully submit that claim 19 is not obvious under 35 U.S.C. § 103(a) in view of Reylek and Squitieri for the reasons discussed above.

Claims 24-25 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Toyota in view of U.S. Patent No. 4,612,601 of Watari ("Watari").


Claims 24-25 have been cancelled.

It is respectfully submitted that in view of the amendments and arguments set forth herein, the applicable rejections and objections have been overcome. If there are any additional charges, please charge Deposit Account No. 02-2666 for any fee deficiency that may be due.

Respectfully submitted,

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